


First Year Results from the Fermi Gamma-ray Space Telescope

Elizabeth Hays
(NASA/GSFC)



Fermi LAT Collaboration

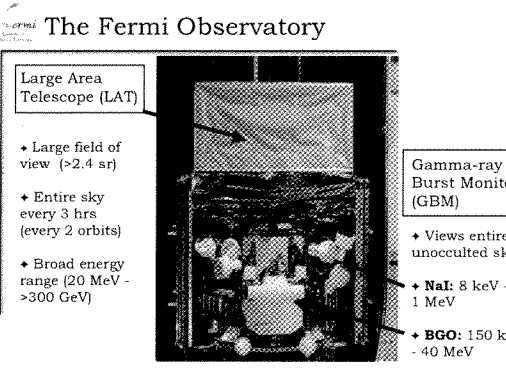
- France**
 - IN2P3-CEA/Baryon
- Italy**
 - INFN-ASI-INFN
- Japan**
 - Hiroshima University
 - ISAS/JAXA
 - Riken
 - Tokyo Institute of Technology
- Sweden**
 - Royal Institute of Technology (KTH)
 - Stockholm University
- United States**
 - Stanford University (SLAC and HEP/Physics)
 - University of California at Santa Cruz - Santa Cruz Institute for Particle Physics
 - Goddard Space Flight Center
 - Naval Research Laboratory
 - Sonoma State University
 - Ohio State University
 - University of Washington

Principal Investigator:
Peter Michelson (Stanford University)

~300 Scientific Members (including 90 Affiliated Scientists, plus 60 Postdocs and 100 Students)

Managed at SLAC

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The Fermi Observatory

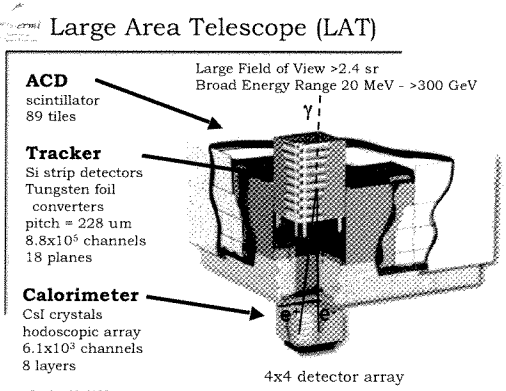
Large Area Telescope (LAT)

- Large field of view (>2.4 sr)
- Entire sky every 3 hrs (every 2 orbits)
- Broad energy range (20 MeV - >300 GeV)

Gamma-ray Burst Monitor (GBM)

- Views entire unocculted sky
- NaI:** 8 keV - 1 MeV
- BGO:** 150 keV - 40 MeV

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Large Area Telescope (LAT)

Large Field of View >2.4 sr
Broad Energy Range 20 MeV - >300 GeV

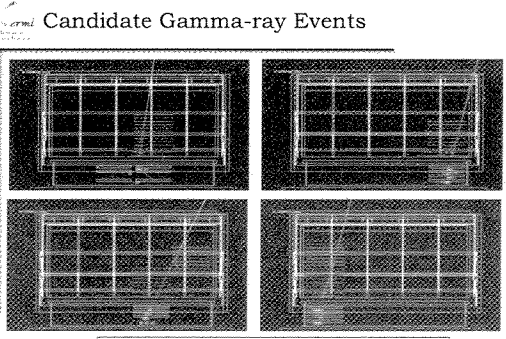
ACD scintillator 89 tiles

Tracker
Si strip detectors
Tungsten foil converters
pitch = 228 μ m
 8.8×10^5 channels
18 planes

Calorimeter
CsI crystals
hodoscopic array
 6.1×10^5 channels
8 layers

4x4 detector array

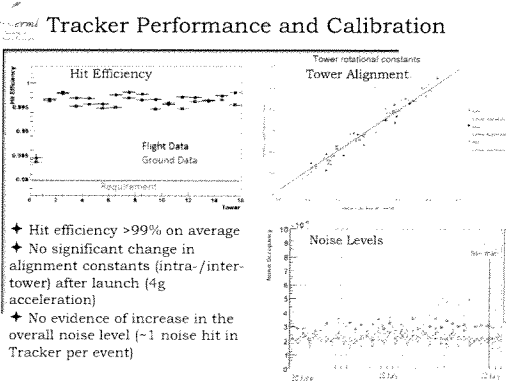
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Candidate Gamma-ray Events

Green crosses --> detected positions of the charged particles
Blue lines --> reconstructed track trajectories
Yellow line --> estimated direction of candidate gamma ray
Red crosses --> detected energy depositions in the calorimeter

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Tracker Performance and Calibration

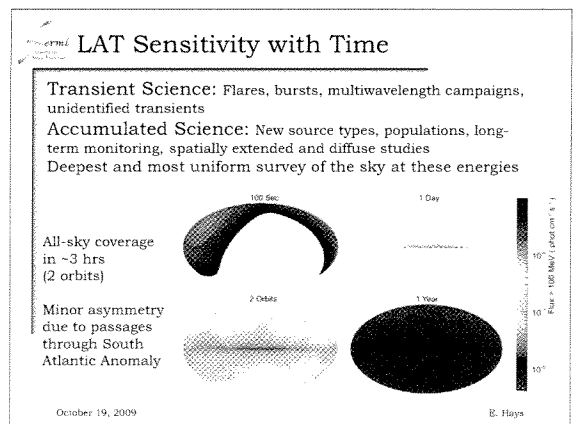
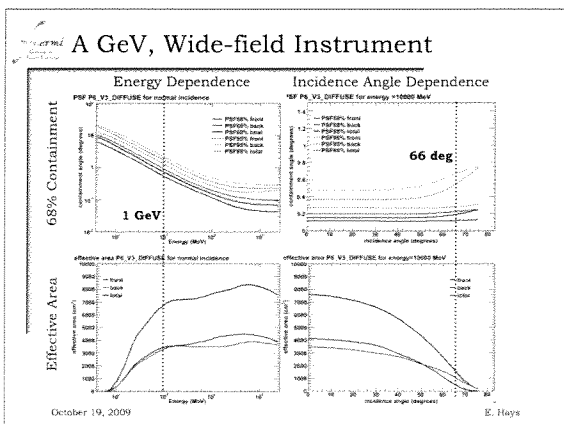
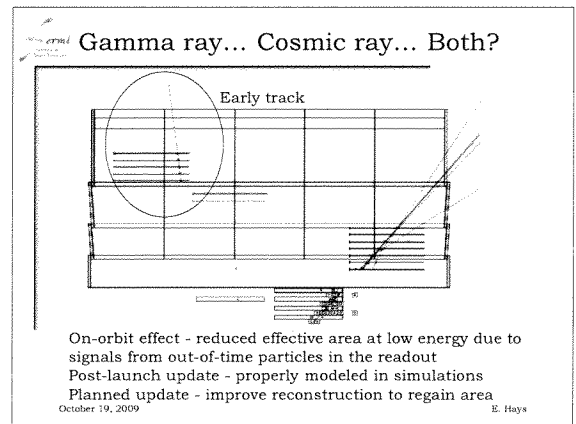
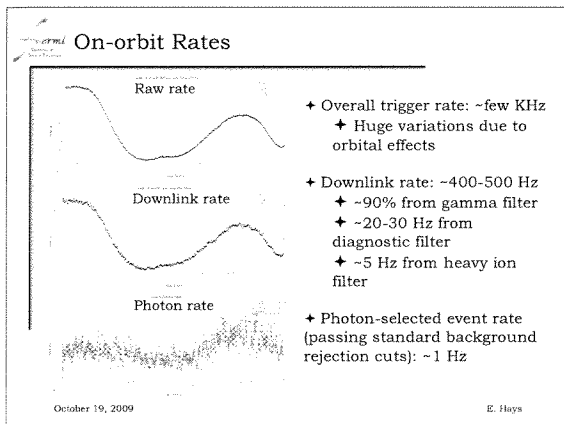
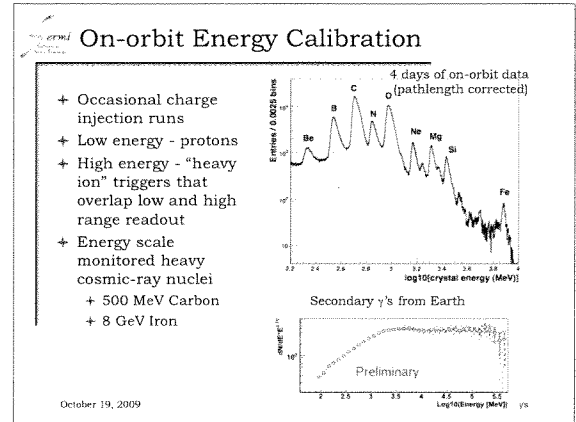
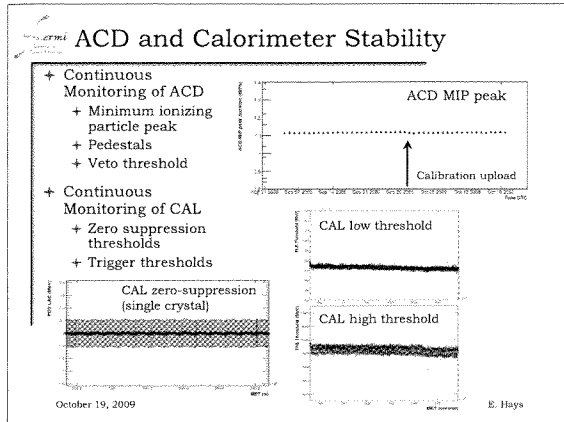
Hit Efficiency

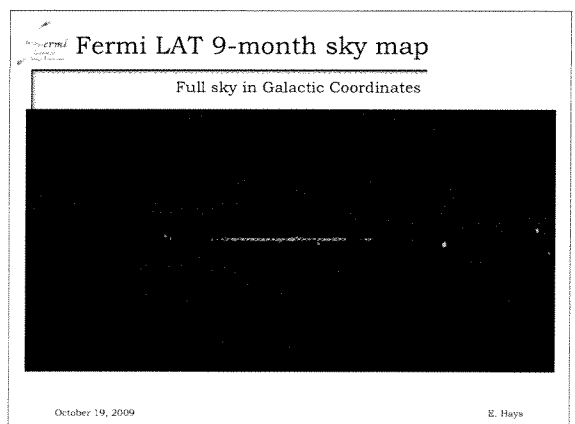
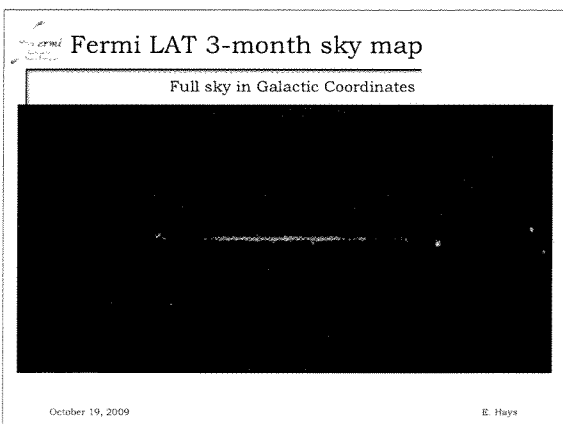
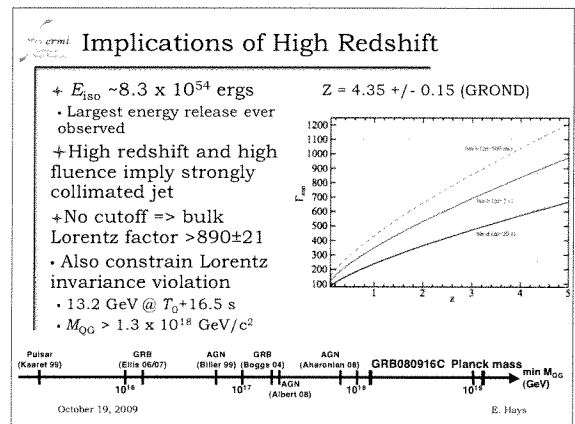
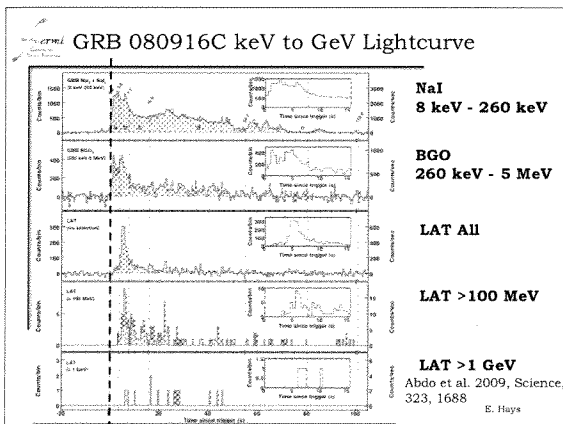
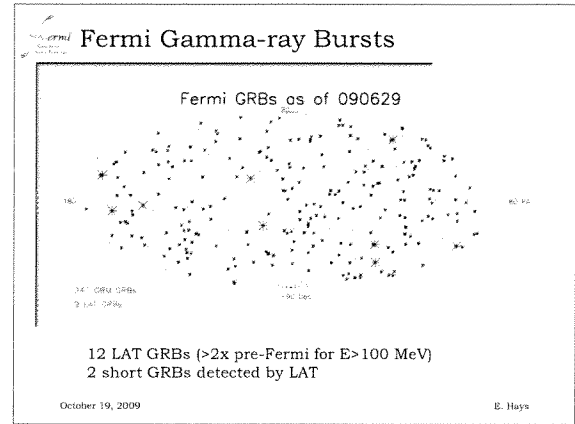
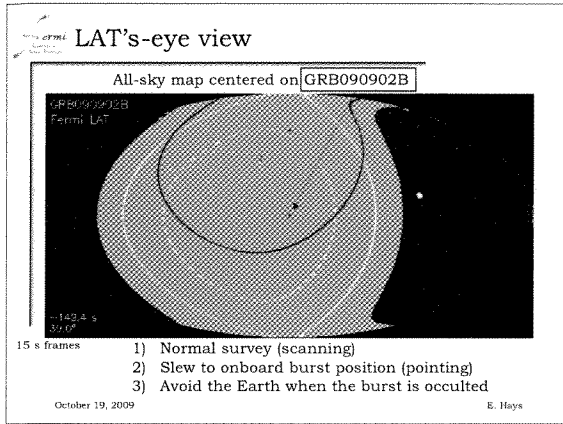
Tower Alignment

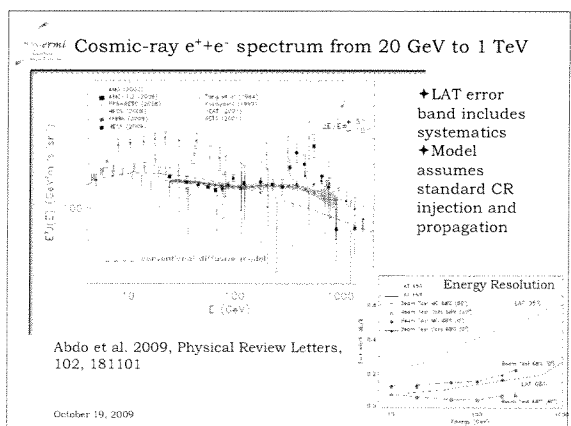
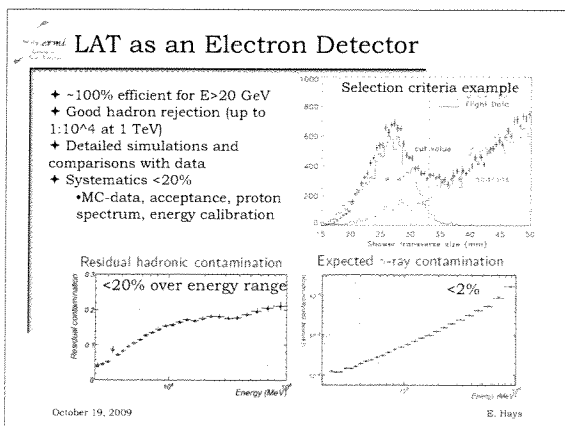
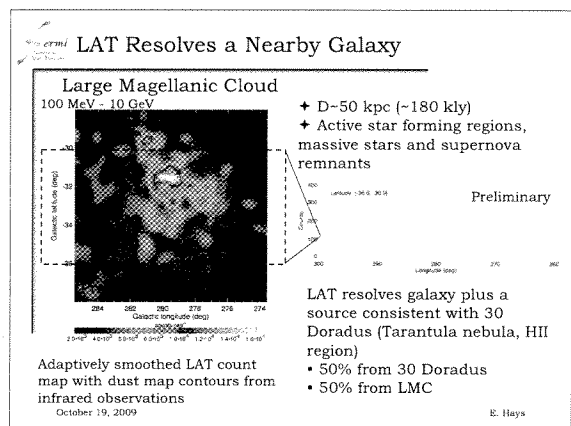
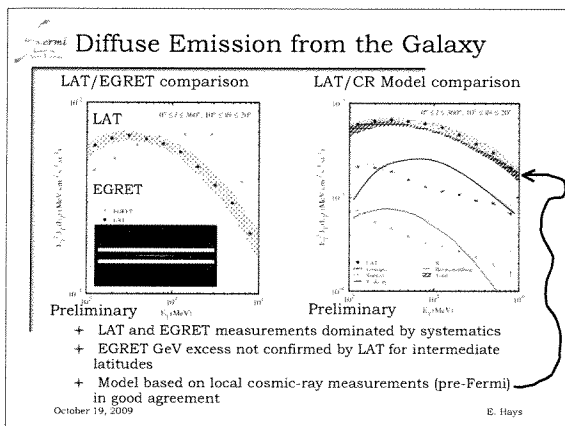
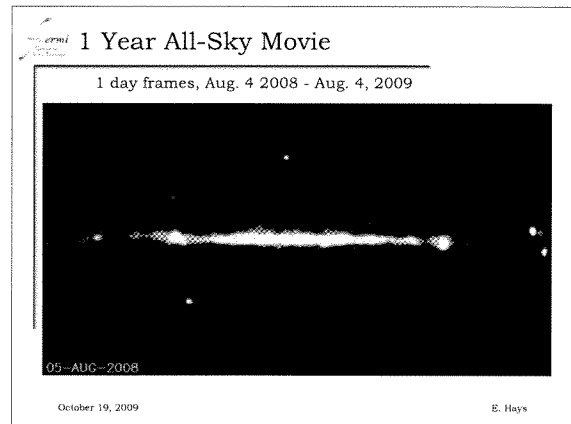
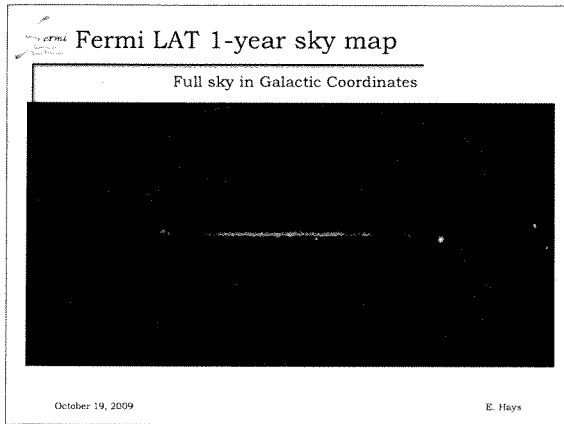
Noise Levels

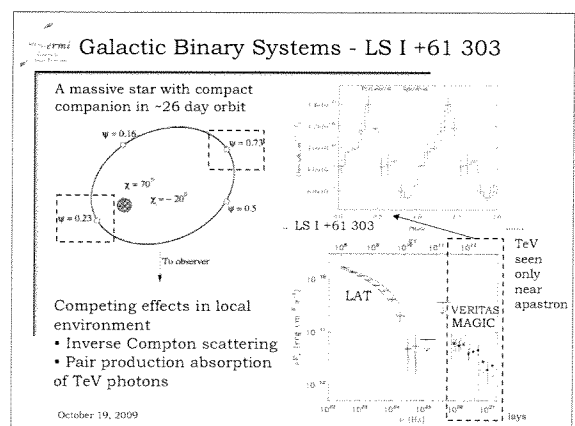
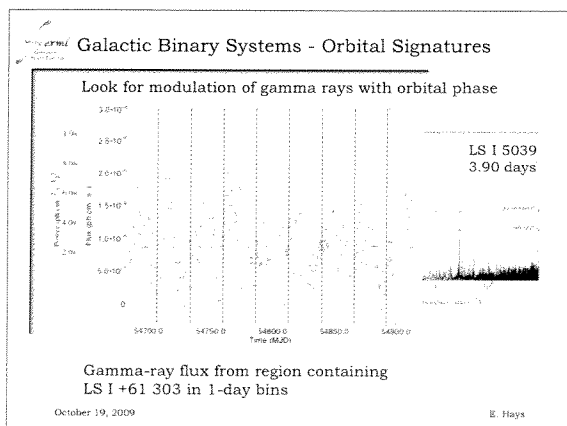
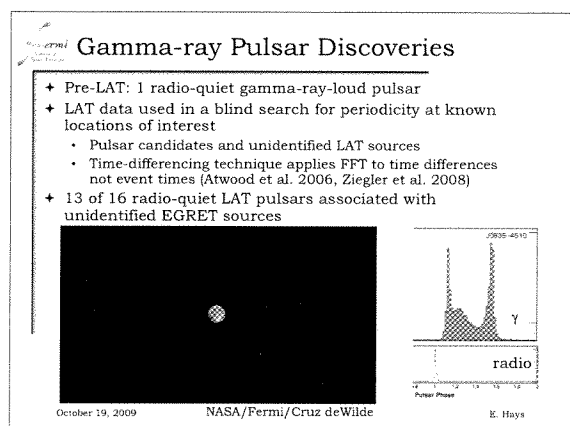
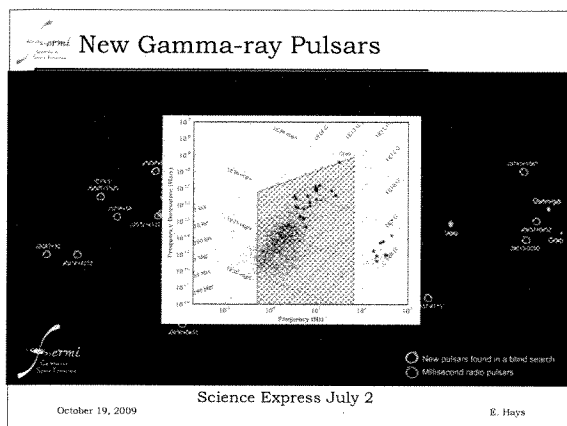
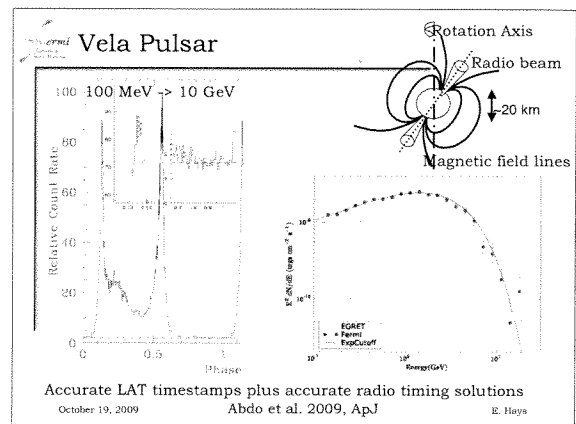
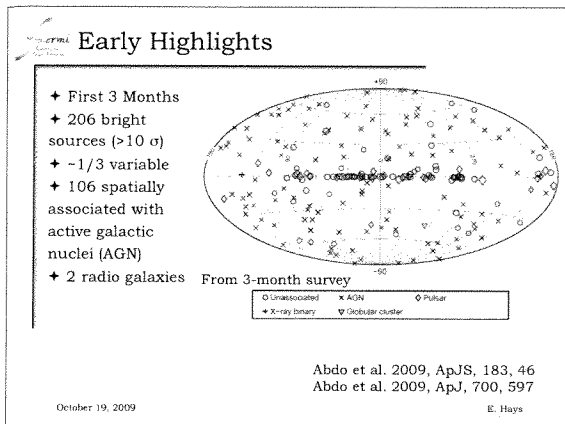
- Hit efficiency $>99\%$ on average
- No significant change in alignment constants (intra-/inter-tower) after launch (4g acceleration)
- No evidence of increase in the overall noise level (~ 1 noise hit in Tracker per event)

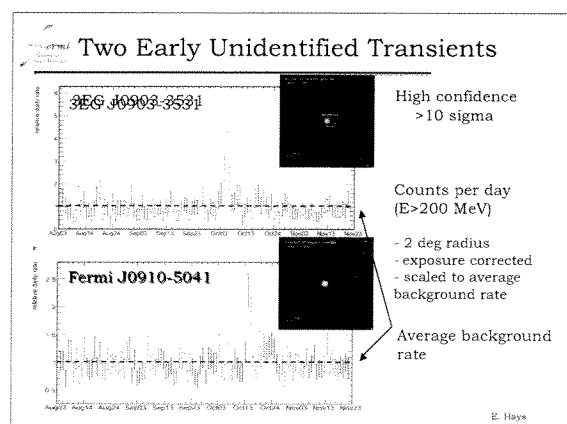
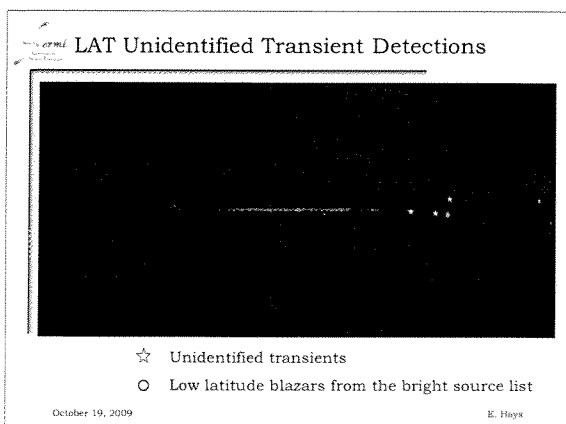
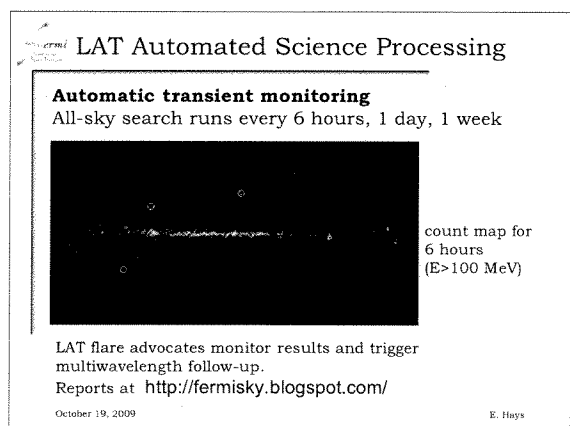
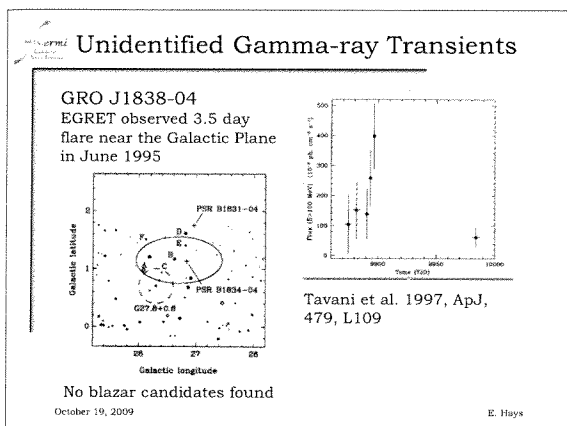
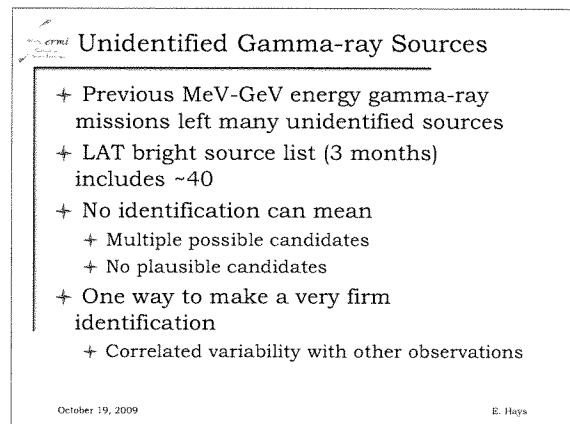
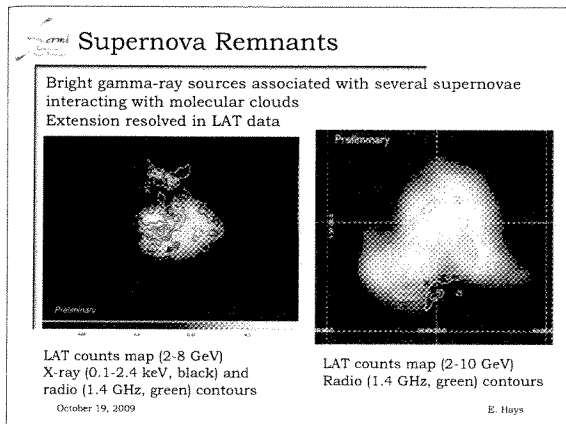
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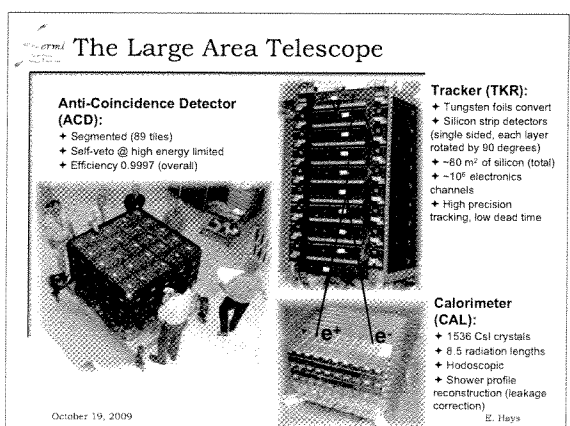
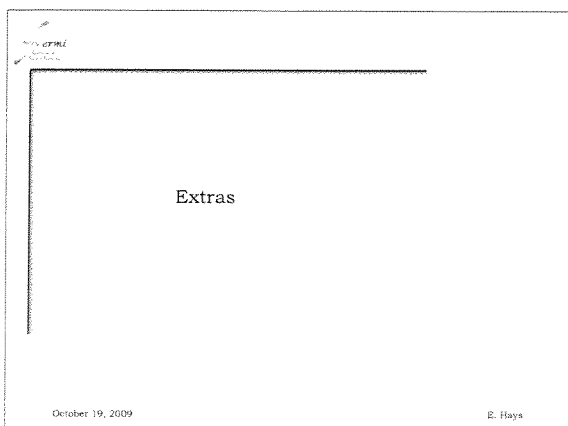
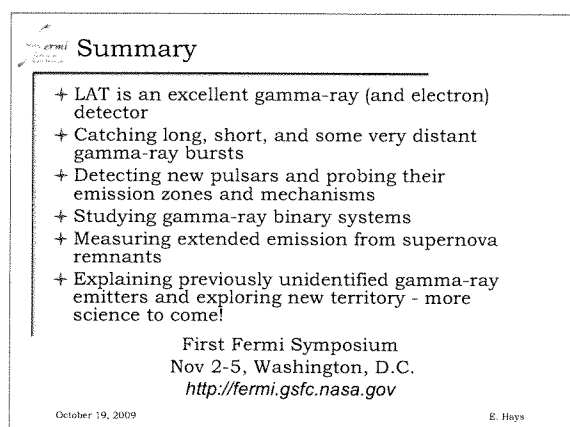
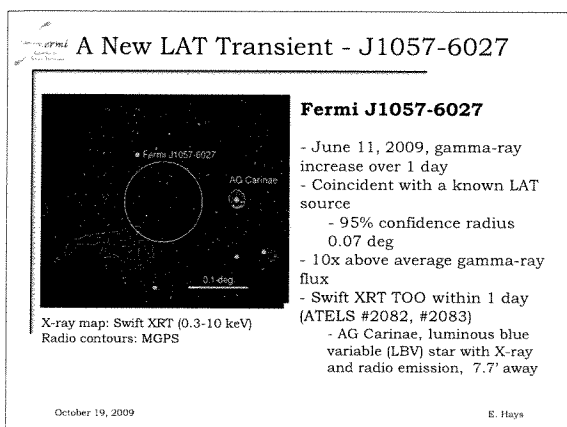
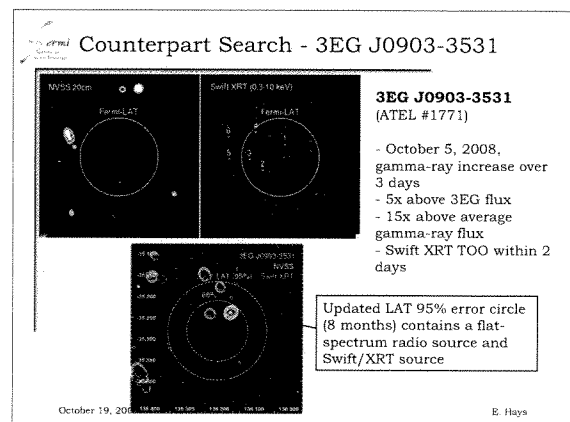
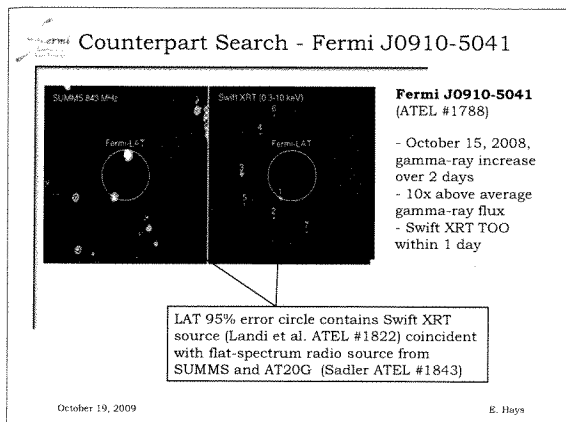


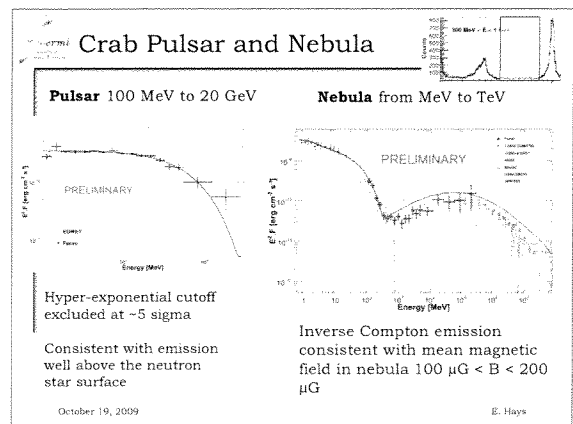
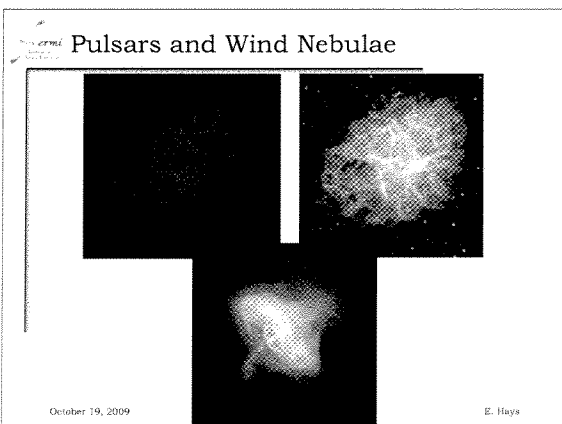
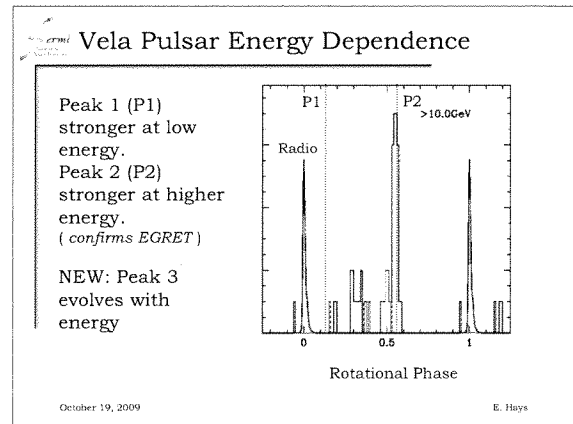
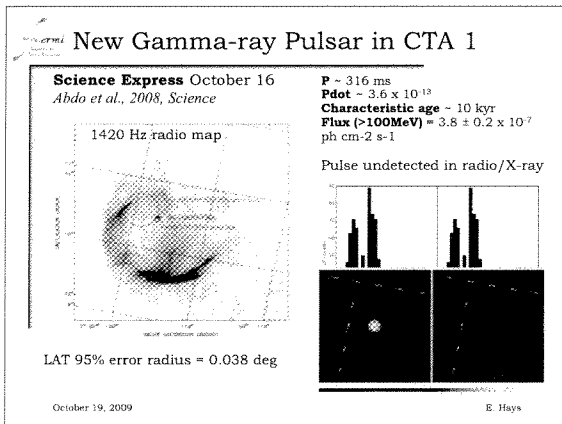
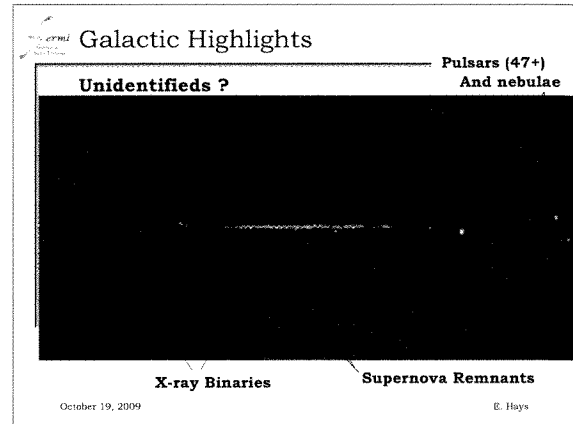
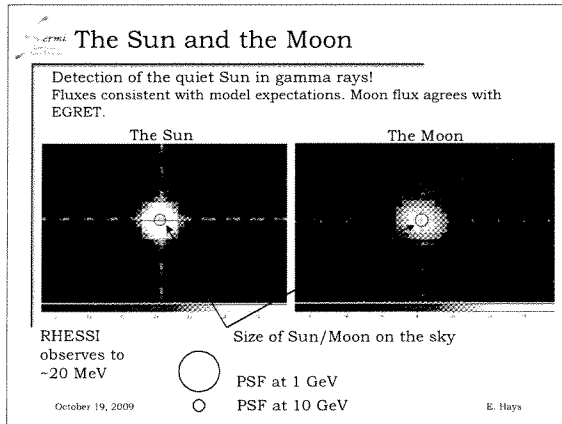


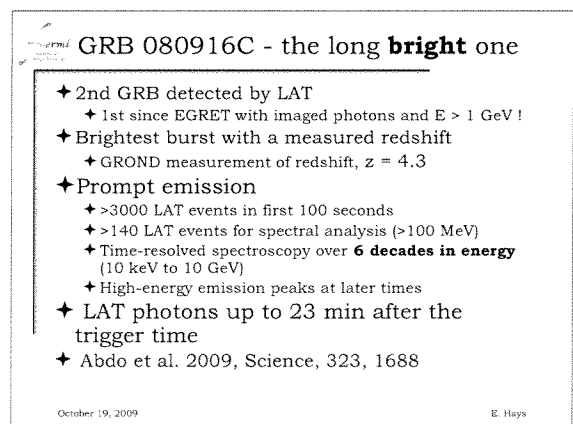
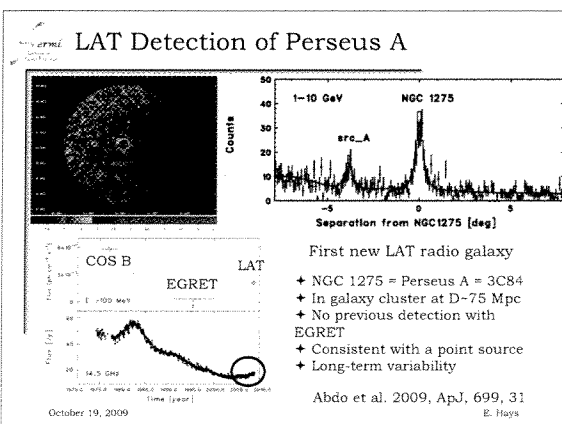
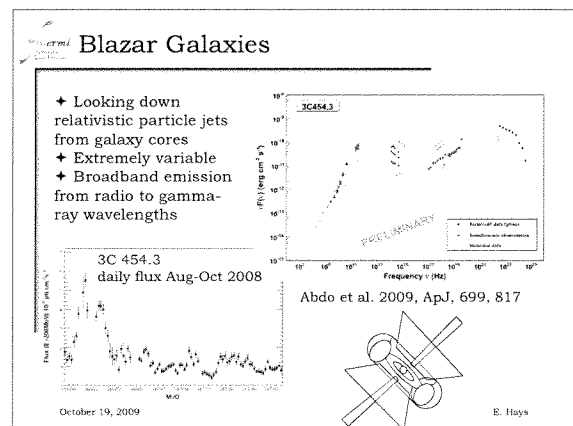
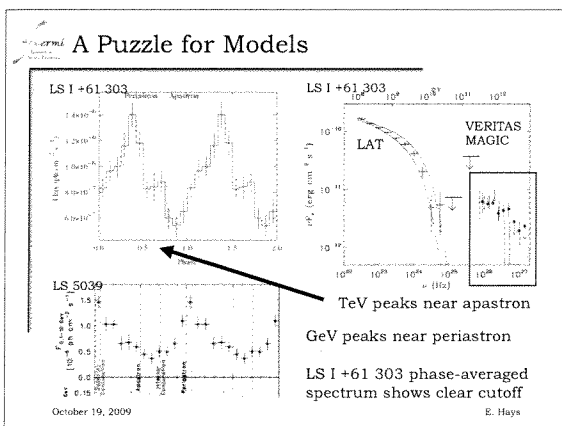
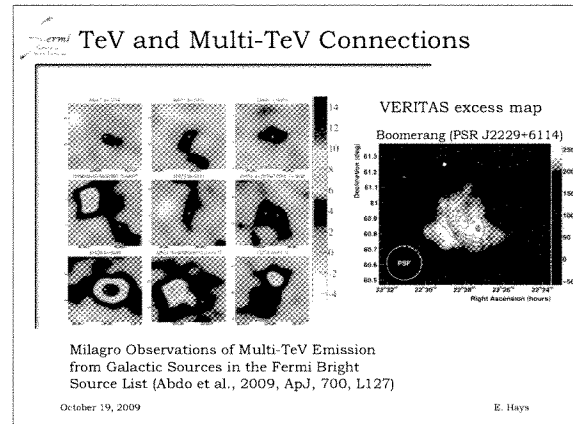
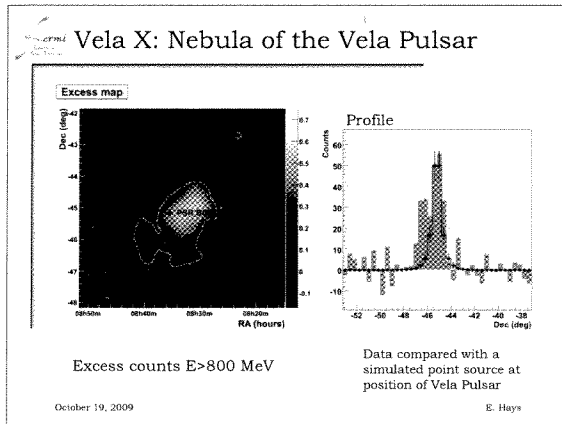


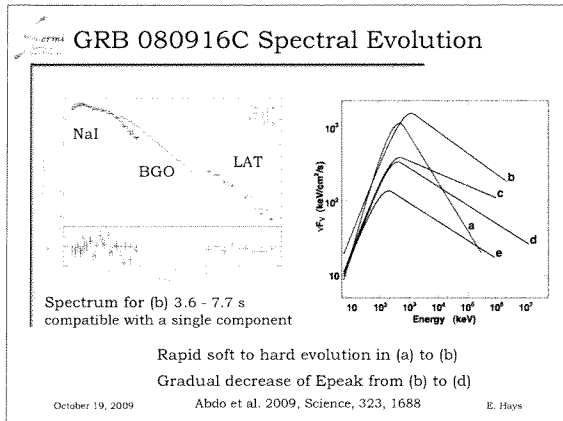












Test of Quantum Gravity

- + Test for energy dispersion of photons
(higher energy arrive later)
 - + $\Delta T \propto \Delta E / M_{\text{QG}}$
- + Strong limit on Lorentz invariance violation
 - + Highest E photon 13.2 GeV $(1+z) = 70.6$ GeV
 - + Arrived 16.5 sec after T0
 - + $\Rightarrow M_{\text{QG}} > 1.30 \times 10^{18} \text{ GeV}/c^2$
 - + $(\sim 0.1 M_{\text{planck}})$

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